

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Previously Presented) A method of manufacturing an embedded multilevel interconnection, comprising:

- (1) forming a hole portion in an insulating layer;
- (2) forming a barrier metal film mainly comprising tantalum and nitrogen in such a manner that the barrier metal film covers at least an inner wall of the hole portion, an element composition ratio (N/Ta) of nitrogen to tantalum contained in the barrier metal film being $0.3 \leq \text{N/Ta} \leq 1.5$;
- (3) removing an oxide film formed on a surface of the barrier metal film; and
- (4) immersing the barrier metal film in a plating liquid comprising copper and thereby forming an electroless copper plating film on the barrier metal film.

2. (Previously Presented) The method according to claim 1, wherein the element composition ratio (N/Ta) is $0.3 \leq \text{N/Ta} \leq 1.0$.

3. (Previously Presented) The method according to claim 1, wherein act (2) comprises irradiating nitrogen plasma upon a surface of a film which is mainly made of tantalum and accordingly nitriding tantalum.

4. (Previously Presented) The method according to claim 1, wherein act (3) comprises removing the oxide film and leaving the barrier metal film in such a manner that the barrier metal film entirely covers the inner wall of the hole portion.

5. (Currently Amended) The method according to claim 1, wherein act (3) comprises immersing the barrier metal film in ~~(1) a solution selected from a group consisting of a mixture of a hydrofluoric acid, and a nitric acid and or (2) a diluted diluent of~~ hydrofluoric acid, and wherein the oxide film is selectively removed.

6. (Previously Presented) The method according to claim 1, wherein act (4) comprises immersing the barrier metal film in a plating liquid which comprises a glyoxylic acid as a reducer.

7. (Currently Amended) The method according to claims 1, further comprising forming an electrolytic copper plating film on the electroless copper plating film by using the electroless copper plating film as a seed layer.

8. (New) A method of manufacturing an embedded multilevel interconnection, comprising:

forming a hole portion in an insulating layer;

forming a barrier metal film mainly comprising tantalum and nitrogen on an inner wall of the hole portion and in so doing controlling composition and thickness of the barrier metal film;

removing an oxide film formed on a surface of the barrier metal film;

immersing the barrier metal film in a plating liquid comprising copper and thereby forming an electroless copper plating film on the barrier metal film;

wherein by controlling the composition and thickness of the barrier metal film, after removal of the oxide film the barrier metal film essentially entirely covers the inner wall of the hole portion, thereby preventing development of a void within the hole portion, and

wherein the controlling of the composition of the barrier metal film comprises selecting an element composition ratio (N/Ta) of nitrogen to tantalum contained in the barrier metal film to be $0.3 \leq \text{N/Ta} \leq 1.5$.

9. (New) The method according to claim 8, wherein forming the barrier metal film comprises forming the barrier metal film mainly to comprise tantalum and nitrogen having the element composition ratio (N/Ta) of $0.3 \leq \text{N/Ta} \leq 1.0$.

10. (New) The method according to claim 8, wherein forming the barrier metal film comprises further comprises irradiating nitrogen plasma upon a surface of a film which is mainly made of tantalum and accordingly nitriding tantalum.

11. (New) The method according to claim 8, wherein removing the oxide film formed on a surface of the barrier metal film comprises immersing the barrier metal film in (1) a mixture of a hydrofluoric acid and a nitric acid or (2) a diluent of hydrofluoric acid, and wherein the oxide film is selectively removed.

12. (New) The method according to claim 1, wherein the act of immersing the barrier metal film in a plating liquid comprises immersing the barrier metal film in a plating liquid which comprises a glyoxylic acid as a reducer.

13. (New) The method according to claim 8, further comprising forming an electrolytic copper plating film on the electroless copper plating film by using the electroless copper plating film as a seed layer.